PATENT ABSTRACTS OF JAPAN

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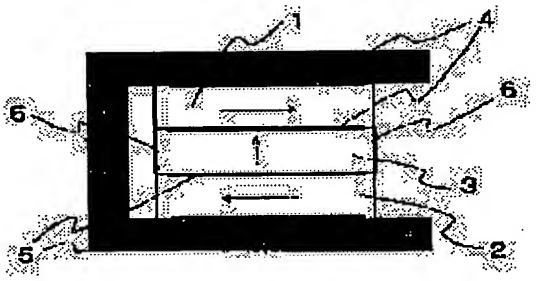
(54) PIEZOELECTRIC TRANSFORMER

(57)Abstract:

PROBLEM TO BE SOLVED: To realize a piezoelectric transformer which is equipped with a vibrator that is easily held through a certain holding method, has a high step-up ratio, and is enhanced in efficiency, by a method wherein the vibrator is a three-layered structure composed of an upper drive part, a lower drive part, and a middle output part sandwiched between the drive parts, the upper and lower surface of the vibrator are fixed, and a drive electric field is applied to enable the output part to start thick-wise sliding vibrations.



SOLUTION: A piezoelectric transformer is composed of a three-layered piezoelectric ceramic body which comprises an upper drive part 1, a lower drive part 2 which are both polarized in opposite directions respectively and a middle output part 3, and a member which fixes the top surfaces and under surfaces of the three-layered parts. The fixing member firmly fixes the upper and lower surfaces of the three-layered parts ceramic body so as not to cause a positional relation change between the upper drive part 1 and the lower drive part 2. The three-layered part 1, 2, and 3 are previously polarized in a direction vertical to the direction of an electric field, and the three-layered parts 1, 2, and 3 start thick-wise sliding vibration when a drive electric field is applied. As one surface of each three-layered part is fixed, the displacement of the drive parts 1 and 2 deforms the middle output part 3 much. By this distortion, an electric field is generated between the electrodes of the middle output part 3 and taken out as an output.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] The piezoelectric transformer characterized by starting thickness slip vibration in the output section by a vertical side being fixed, having 3–fold structure where the output section laps with the vertical section mutually in a mechanical component and pars intermedia, and impressing drive electric field.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Specifically, this invention relates to structure amelioration of vibrator about a piezoelectric transformer.
[0002]
[Description of the Prior Art] the spread of a note type personal computer, Personal Digital Assistants, etc. — following — back light lighting for the former and liquid crystal — electromagnetism — the pressure up has been performed using a transformer. however, generating — electromagnetism — recently, a piezoelectric transformer is beginning to spread by the demand of the reduction in the small back of reduction of a noise, low-power-izing, efficient-izing, and the transformer themselves etc.
[0003] The Rosen mold is in the configuration of a typical piezoelectric transformer. This polarizes the one half of the die-length direction of a ceramic rectangle plate in the thickness direction, considers as a driving side, polarizes another one half in the die-length direction, considers as an output side, and is vibrated by the case (lambda mode) where the condition (lambda/2 mode) whose 1/2 wave of a standing wave mainly corresponds with the die length of a transformer as the mode at the time of resonance, or one wave is in agreement with the die length of a transformer.
[0004] In the case of the Rosen mold, the pressure-up ratio of a piezoelectric transformer is expressed with V2-/V1=(4xQmxK31xK33xL)/(pi2xt). Thus, although an electromechanical coupling coefficient K participates in a pressure-up ratio, if structure is changed and longitudinal oscillation is used for a driving side, instead of K31 which shows the die-length direction where a value is small, K33 which shows a lengthwise direction will become the main element. Therefore, improvement in a pressure-up ratio can be aimed at, and there is effectiveness also in reduction of driver voltage as a result.
[0005]
[Problem(s) to be Solved by the Invention] However, the conventional piezoelectric transformer mentioned above has the following faults. That is, support of vibrator is usually performed in the contact of vibration. In fact, although a support rack and vibrator are fixed with adhesives, such as silicone, the activity of pasting up the narrowest possible area part is needed firmly [so that it may not exfoliate in vibration] so that vibration may not be checked. However, vibration is checked by performing required sufficient immobilization in fact, or dispersion arises in the fixed approach, and there is a problem which leads to decline in the effectiveness as a transformer.
[0006] In order for a pressure-up ratio to obtain an efficient high piezoelectric transformer, it is indispensable that an electromechanical coupling coefficient K is high. Although the same ingredient also has K which changed with oscillation modes and K15 of thickness slip vibration shows the highest value, there are few examples actually used. Therefore, since the electromechanical coupling coefficient K

used as the max which the ingredient itself has is not used, there is a problem which has not fully employed the material property efficiently.

[0007] Therefore, the manner of support of vibrator is easy for this invention, and its pressure-up ratio is high, and it is to offer an efficient piezoelectric transformer.

[0008]

[Means for Solving the Problem] Since according to this invention it drives where the 2nd page of vibrator is fixed, vibrator support can be performed very easily, it has a high pressure-up ratio by using K15 of thickness slip vibration with the largest value for the electromechanical coupling coefficient greatly concerned with a pressure-up ratio in a material property value at both I/O, and the transformer which it is efficient and can be used is obtained.

[0009] That is, this invention is a vertical side's being fixed, having 3-fold structure the output section's lapping with the vertical section mutually in a mechanical component and pars intermedia, and impressing drive electric field, and is a piezoelectric transformer which starts thickness slip vibration in the output section.

[0010]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to a drawing.

[0011] Drawing 1 is the block diagram of the piezoelectric transformer by the gestalt of operation of this invention. It consists of the electrostrictive ceramics, the upper mechanical component 1 and the lower layer mechanical component 2 by which polarization was carried out in each direction, and the interlayer output section, of three layers, and consists of the part which fixes the vertical side of them. As for a fixed portion, being fixed firmly is desirable so that the physical relationship of the upper mechanical component 1 and the lower layer mechanical component 2 may not change. It has the upper drive electrode 4 and the lower layer drive electrode 5 in the upper layer and a lower layer vertical side, and has the electrode 6 for output Rhine in an interlayer's right and left respectively. Beforehand, the direction of electric field is polarization's being carried out to the right angle and impressing drive electric field, and three layers perform thickness slip vibration.

[0012] Drawing 2 and drawing 3 are the plugging charts and oscillating model Figs. of a piezoelectric transformer by the gestalt of operation of this invention respectively. Thickness slip vibration arises by impressing electric field in phase to the upper mechanical component 1 and the lower layer mechanical component 2. That is, as the field which touches each interlayer displaces to hard flow, on a top face and the inferior surface of tongue, it is the configuration that the direction of polarization conflicts. Since the 1st page is being fixed respectively, the variation rate of the upper mechanical component 1 and the lower layer mechanical component 2 is made to transform the interlayer output section 3 greatly. In the interlayer output section 3, electric field are produced in inter-electrode [that], and it is taken out as an output by this strain.

[0013] Drawing 4 and drawing 5 are the mimetic diagrams which expressed actuation of the mechanical component of the piezoelectric transformer by the gestalt of operation of this invention, and the output section respectively.

[0014]

[Effect of the Invention] According to this invention, like the above explanation, a high pressure-up ratio and an efficient piezoelectric transformer can be offered by using the thickness slip vibration in which a driving side and an output side have K15 with a high electromechanical coupling coefficient.

[0015] moreover, the structure which fixes the vertical side of vibrator sake -- the conventional transformer -- comparing -- support -- easy -- in addition -- and a piezoelectric transformer with few losses of vibration by support can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the piezoelectric transformer by the gestalt of operation of this invention.
[Drawing 2] The mimetic diagram of the piezoelectric transformer by the gestalt of operation of this invention.
[Drawing 3] the trembler of the piezoelectric transformer by the gestalt of operation of this invention — the model Fig. of a variation rate.
[Drawing 4] The Fig. of the mechanical component of the piezoelectric transformer by the gestalt of operation of this invention of operation.
[Drawing 5] The Fig. of the output section of the piezoelectric transformer by the gestalt of operation of this invention of operation.
[Description of Notations]
1 The Upper Mechanical Component
2 Lower Layer Mechanical Component
3 Interlayer Output Section
4 Electrode for the Upper Drive
5 Electrode for Lower Layer Drive
6 Electrode for Output Rhine

[Translation done.]

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審査請求　未請求　請求項の数１　ＦＤ　（全 ３ 頁）

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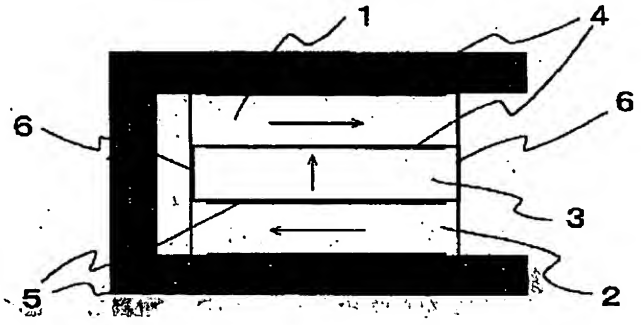
(54)【発明の名称】　圧電トランス

(57)【要約】

【課題】　振動子の支持方法が容易で、昇圧比が高く、高効率な圧電トランスを提供すること。

【解決手段】　振動子の上層駆動部１の上面と下層駆動部２の下面を固定する構造により、支持が容易となり、更に、材料特性を十分に生かした厚み滑り振動を入出力双方に利用することで、高い昇圧比が得られる高効率な圧電トランス。



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【特許請求の範囲】

【請求項１】　上下面が固定され、上下部に駆動部と中間部に出力部とが互いに重なる３重構造を持ち、駆動電界を印加することで、出力部に厚み滑り振動を起こすことを特徴とする圧電トランス。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、圧電トランスに関するもので、具体的には、振動子の構造改良に関するものである。

【０００２】

【従来の技術】ノート型パーソナルコンピュータ、携帯情報端末などの普及に伴い、従来、液晶用バックライト点灯には、電磁トランスを用いて昇圧を行ってきた。しかし、発生電磁ノイズの低減、低消費電力化、高効率化、トランス自体の小型低背化などの要求により、最近では、圧電トランスが普及し始めている。

【０００３】代表的な圧電トランスの形状に、ローゼン型がある。これは、セラミック矩形板の長さ方向の半分を厚み方向に分極し駆動側とし、もう一方の半分を長さ方向に分極し出力側とし、主に共振時のモードとして定在波の１／２波長がトランスの長さに一致する状態（λ／２モード）または１波長がトランスの長さに一致する場合（λモード）で振動させるものである。

【０００４】圧電トランスの昇圧比は、ローゼン型の場合、$V_2/V_1=(4\times Qm\times K31\times K33\times L)/(\pi^2\times t)$で表される。このように、昇圧比には、電気機械結合係数Ｋが関与するが、構造を変え、縦振動を駆動側に用いれば、値の小さい長さ方向を示すＫ３１に代わり、縦方向を示すＫ３３が主要素になる。従って、昇圧比の向上がはかれ、結果として、駆動電圧の低減にも効果がある。

【０００５】

【発明が解決しようとする課題】しかし、上述した従来の圧電トランスには、次のような欠点がある。即ち、通常、振動子の支持は、振動の接点において行われる。実際には、支持架と振動子をシリコーン等の接着剤で固定するが、振動で剥離しないよう強固に、かつ、振動を阻害しないように、できる限り狭い面積部分を接着するという作業を必要とする。しかし、実際には、必要十分な固定を行うことで振動が阻害されたり、固定方法にばらつきが生じ、トランスとしての効率の低下につながる問題がある。

【０００６】昇圧比が高く高効率な圧電トランスを得るには、電気機械結合係数Ｋが高いことが必須である。同じ材料でも、振動モードにより異なったＫを持ち、最も高い値を示すのが、厚み滑り振動のＫ１５であるが、実際に利用される例は少ない。よって、材料そのものの持つ最大となる電気機械結合係数Ｋを利用していないため、材料特性を十分に生かしていない問題がある。

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【０００７】従って、本発明は、振動子の支持方法が容易で、昇圧比が高く、高効率な圧電トランスを提供することにある。

【０００８】

【課題を解決するための手段】本発明によれば、振動子の２面を固定した状態で駆動するため、極めて容易に振動子支持ができ、昇圧比に大きく関わる電気機械結合係数に材料特性値の中で最も値の大きい厚み滑り振動のＫ１５を入出力双方に利用することで、高い昇圧比を持ち、高効率で使用できるトランスが得られる。

【０００９】即ち、本発明は、上下面が固定され、上下部に駆動部と中間部に出力部とが互いに重なる３重構造を持ち、駆動電界を印加することで、出力部に厚み滑り振動を起こす圧電トランスである。

【００１０】

【発明の実施の形態】以下、本発明の実施の形態について、図面を参照しながら説明する。

【００１１】図１は、本発明の実施の形態による圧電トランスの構成図である。各々の方向に分極された上層駆動部１と下層駆動部２と中間層出力部の三層の圧電セラミックスから成り、それらの上下面を固定する部分から成り立つ。固定部分は、上層駆動部１と下層駆動部２の位置関係が変化しないよう、強固に固定されるのが望ましい。上層及び下層の上下面に、各々、上層駆動電極４と下層駆動電極５を、中間層の左右に出力ライン用電極６を持つ。三層は、あらかじめ電界方向とは直角に分極されており、駆動電界を印加することで、厚み滑り振動を行う。

【００１２】図２、図３は、各々、本発明の実施の形態による圧電トランスの配線図および振動モデル図である。上層駆動部１、下層駆動部２に、同位相の電界を印加することで、厚み滑り振動が生じる。即ち、各々の中間層に接する面が逆方向に変位するよう、上面と下面では分極方向が相反するような構成である。各々１面が固定されていることから、上層駆動部１、下層駆動部２の変位は、中間層出力部３を大きく変形させる。このひずみにより、中間層出力部３では、その電極間に電界を生じ、出力として取り出される。

【００１３】図４、図５は、各々本発明の実施の形態による圧電トランスの駆動部および出力部の動作を表わした模式図である。

【００１４】

【発明の効果】以上の説明のように、本発明によれば、駆動側、出力側共に電気機械結合係数の高いＫ１５を持つ厚み滑り振動を用いることで、高昇圧比、高効率の圧電トランスが提供できる。

【００１５】また、振動子の上下面を固定する構造のため、従来のトランスに比べ支持が容易で、なおかつ、支持による振動のロスが少ない圧電トランスが提供できる。

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【図面の簡単な説明】

【図１】本発明の実施の形態による圧電トランスの構成図。

【図２】本発明の実施の形態による圧電トランスの模式図。

【図３】本発明の実施の形態による圧電トランスの振動子変位のモデル図。

【図４】本発明の実施の形態による圧電トランスの駆動部の動作図。

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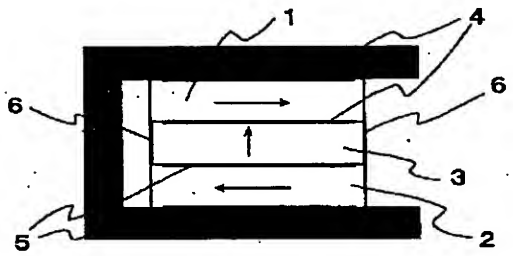
【図５】本発明の実施の形態による圧電トランスの出力部の動作図。

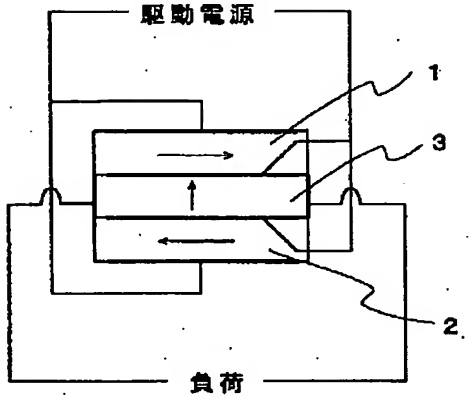
【符号の説明】

1　上層駆動部
2　下層駆動部
3　中間層出力部
4　上層駆動用電極
5　下層駆動用電極
6　出力ライン用電極

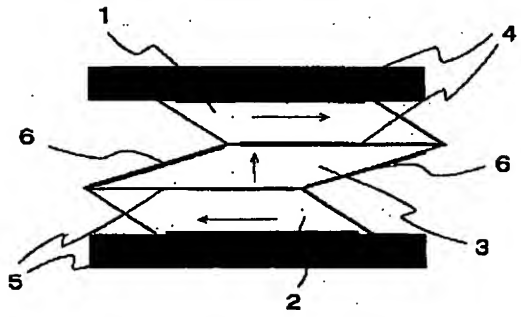
【図１】



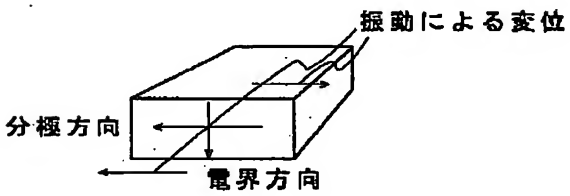
【図２】



【図３】



【図４】



【図５】